

PATENT

122-113

5 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re

10 UNITED STATES PATENT APPLICATION

Of

15 RICHARD A. STEINER

Relating to

20 COMPRESSION TOOL WITH TOGGLE ACTION

25

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to axial cable connection compression tools generally and, more particularly, but not by way of limitation, to a novel axial cable connection compression tool having a toggle action and, with variations of a basic form, is able to compress a wide range of end connectors.

Background Art

10 Coaxial cables are used in a wide variety of applications. Such cables have end connectors that are typically applied using a compression tool to interfit the component parts of the connectors.

15 A typical compression tool is limited in mechanical advantage. For example, with one commonly used compression tool, mechanical advantage increases from 4.5:1 at beginning of compression to only 15.25:1 at final compression position. This increases operator fatigue and reduces productivity, since a relatively high degree of manual force is required. Also, the end of the compression cycle is not clearly defined, thus allowing connectors, which require high loads, not to be fully compressed. Most compression tools are not
20 configured for accessory products and thus are limited in the range of connectors that can be accommodated by one compression tool.

Furthermore, known compression tools do not have a conveniently used integral coaxial cable stripper.

25 Accordingly, it is a principal object of the present invention to provide a coaxial cable end connector compression tool that has a high range of mechanical advantage.

It is a further object of the invention to provide such a tool that can accommodate a wide range of end connectors, with minor modifications thereto.

It is an additional object of the invention to provide such a tool that has a

COMPRESSION TOOL WITH TOGGLE ACTION

Inventor: Richard A. Steiner

PATENT

122-113

clear tactile indication of the end of a compression cycle.

It is another object of the invention to provide such a tool that can be economically manufactured.

5 It is yet a further object of the invention to provide such a tool that has a conveniently used integral coaxial cable stripper.

Other objects of the present invention, as well as particular features, elements, and advantages thereof, will be elucidated in, or be apparent from, the following description and the accompanying drawing figure.

10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
465
470
475
480
485
490
495
500
505
510
515
520
525
530
535
540
545
550
555
560
565
570
575
580
585
590
595
600
605
610
615
620
625
630
635
640
645
650
655
660
665
670
675
680
685
690
695
700
705
710
715
720
725
730
735
740
745
750
755
760
765
770
775
780
785
790
795
800
805
810
815
820
825
830
835
840
845
850
855
860
865
870
875
880
885
890
895
900
905
910
915
920
925
930
935
940
945
950
955
960
965
970
975
980
985
990
995

SUMMARY OF THE INVENTION

The present invention achieves the above objects, among others, by providing, in a preferred embodiment, an end connector compression tool, comprising; a body; supports to support a cable and uncompressed end connector parts; a compression member axially movable with respect to said body to fixedly attach said end connector parts to said cable by compression of said end connector parts; a handle rotatably attached to said compression member at a first pivot point; and a link rotatably attached to said handle at a second pivot point and to said body at a third pivot point, such that rotation of said handle from an open position to a closed position effects compressive fixed attachment of said end connector parts to said cable. Said tool may have an integral coaxial cable stripping function included therein.

107. 6897 6898 6899 6900 6901 6902 6903 6904 6905
 108. 6906 6907 6908 6909 6910 6911 6912 6913 6914
 109. 6915 6916 6917 6918 6919 6920 6921 6922 6923
 110. 6924 6925 6926 6927 6928 6929 6930 6931 6932
 111. 6933 6934 6935 6936 6937 6938 6939 6940 6941
 112. 6942 6943 6944 6945 6946 6947 6948 6949 6950
 113. 6951 6952 6953 6954 6955 6956 6957 6958 6959
 114. 6960 6961 6962 6963 6964 6965 6966 6967 6968
 115. 6969 6970 6971 6972 6973 6974 6975 6976 6977
 116. 6978 6979 6980 6981 6982 6983 6984 6985 6986
 117. 6987 6988 6989 6990 6991 6992 6993 6994 6995
 118. 6996 6997 6998 6999 7000 7001 7002 7003 7004
 119. 7005 7006 7007 7008 7009 7010 7011 7012 7013
 120. 7014 7015 7016 7017 7018 7019 7020 7021 7022
 121. 7023 7024 7025 7026 7027 7028 7029 7030 7031
 122. 7032 7033 7034 7035 7036 7037 7038 7039 7040
 123. 7041 7042 7043 7044 7045 7046 7047 7048 7049
 124. 7050 7051 7052 7053 7054 7055 7056 7057 7058
 125. 7059 7060 7061 7062 7063 7064 7065 7066 7067
 126. 7068 7069 7070 7071 7072 7073 7074 7075 7076
 127. 7077 7078 7079 7080 7081 7082 7083 7084 7085
 128. 7086 7087 7088 7089 7090 7091 7092 7093 7094
 129. 7095 7096 7097 7098 7099 7100 7101 7102 7103
 130. 7104 7105 7106 7107 7108 7109 7110 7111 7112
 131. 7113 7114 7115 7116 7117 7118 7119 7120 7121
 132. 7122 7123 7124 7125 7126 7127 7128 7129 7130
 133. 7131 7132 7133 7134 7135 7136 7137 7138 7139
 134. 7140 7141 7142 7143 7144 7145 7146 7147 7148
 135. 7149 7150 7151 7152 7153 7154 7155 7156 7157
 136. 7158 7159 7160 7161 7162 7163 7164 7165 7166
 137. 7167 7168 7169 7170 7171 7172 7173 7174 7175
 138. 7176 7177 7178 7179 7180 7181 7182 7183 7184
 139. 7185 7186 7187 7188 7189 7190 7191 7192 7193
 140. 7194 7195 7196 7197 7198 7199 7200 7201 7202
 141. 7203 7204 7205 7206 7207 7208 7209 7210 7211
 142. 7212 7213 7214 7215 7216 7217 7218 7219 7220
 143. 7221 7222 7223 7224 7225 7226 7227 7228 7229
 144. 7230 7231 7232 7233 7234 7235 7236 7237 7238
 145. 7239 7240 7241 7242 7243 7244 7245 7246 7247
 146. 7248 7249 7250 7251 7252 7253 7254 7255 7256
 147. 7257 7258 7259 7260 7261 7262 7263 7264 7265
 148. 7266 7267 7268 7269 7270 7271 7272 7273 7274
 149. 7275 7276 7277 7278 7279 7280 7281 7282 7283
 150. 7284 7285 7286 7287 7288 7289 7290 7291 7292
 151. 7293 7294 7295 7296 7297 7298 7299 7300 7301
 152. 7302 7303 7304 7305 7306 7307 7308 7309 7310
 153. 7311 7312 7313 7314 7315 7316 7317 7318 7319
 154. 7320 7321 7322 7323 7324 7325 7326 7327 7328
 155. 7329 7330 7331 7332 7333 7334 7335 7336 7337
 156. 7338 7339 7340 7341 7342 7343 7344 7345 7346
 157. 7347 7348 7349 7350 7351 7352 7353 7354 7355
 158. 7356 7357 7358 7359 7360 7361 7362 7363 7364
 159. 7365 7366 7367 7368 7369 7370 7371 7372 7373
 160. 7374 7375 7376 7377 7378 7379 7380 7381 7382
 161. 7383 7384 7385 7386 7387 7388 7389 7390 7391
 162. 7392 7393 7394 7395 7396 7397 7398 7399 7400
 163. 7401 7402 7403 7404 7405 7406 7407 7408 7409
 164. 7410 7411 7412 7413 7414 7415 7416 7417 7418
 165. 7419 7420 7421 7422 7423 7424 7425 7426 7427
 166. 7428 7429 7430 7431 7432 7433 7434 7435 7436
 167. 7437 7438 7439 7440 7441 7442 7443 7444 7445
 168. 7446 7447 7448 7449 7450 7451 7452 7453 7454
 169. 7455 7456 7457 7458 7459 7460 7461 7462 7463
 170. 7464 7465 7466 7467 7468 7469 7470 7471 7472
 171. 7473 7474 7475 7476 7477 7478 7479 7480 7481
 172. 7482 7483 7484 7485 7486 7487 7488 7489 7490
 173. 7491 7492 7493 7494 7495 7496 7497 7498 7499
 174. 7500 7501 7502 7503 7504 7505 7506 7507 7508
 175. 7509 7510 7511 7512 7513 7514 7515 7516 7517
 176. 7518 7519 7520 7521 7522 7523 7524 7525 7526
 177. 7527 7528 7529 7530 7531 7532 7533 7534 7535
 178. 7536 7537 7538 7539 7540 7541 7542 7543 7544
 179. 7545 7546 7547 7548 7549 7550 7551 7552 7553
 180. 7554 7555 7556 7557 7558 7559 7560 7561 7562
 181. 7563 7564 7565 7566 7567 7568 7569 7570 7571
 182. 7572 7573 7574 7575 7576 7577 7578 7

BRIEF DESCRIPTION OF THE DRAWING

Understanding of the present invention and the various aspects thereof will be facilitated by reference to the accompanying drawing figures, provided for purposes of illustration only and not intended to define the scope of the invention, on which:

Figure 1 is a side elevational view of a basic compression tool according to the present invention, the tool being shown in open, non-compressing, position.

Figure 2 is a side elevational view of the compression tool, the tool being shown in closed, end-of-compression-cycle, position.

Figure 3 is a top plan view of the compression tool.

Figure 4 is a bottom plan view of the compression tool.

Figure 5 is a fragmentary, side elevational view of the compression tool in open position, with uncompressed end connection parts the end of a cable inserted therein.

Figure 6 is a fragmentary, side elevational view of the compression tool in fully closed position, with the end connection parts and the cable assembled.

Figure 7 is an end elevational view of the compression tool.

Figure 8 is a fragmentary, side elevational view of an embodiment of the compression tool employing auxiliary compression jaws.

Figure 9 is an end elevational view of the embodiment of Figure 8.

Figure 10 is a side elevational view of another embodiment of the compression tool.

Figures 11 and 12 are top plan and end elevational views, respectively, showing the tool of Figure 10 configured to attach end connectors to one range of sizes of coaxial cable.

Figures 13 and 14 are top plan and end elevational views, respectively, showing the tool of Figure 10 configured to attach end connectors to another range of sizes of coaxial cable.

Figure 16 is a fragmentary, top plan view, taken along line “16-16” of Figure 15.

5

[illegible]

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference should now be made to the drawing figures on which similar or identical elements are given consistent identifying numerals throughout the various figures thereof, and on which parenthetical references to figure numbers direct the reader to the view(s) on which the element(s) being described is (are) best seen, although the element(s) may be seen on other figures also.

Figure 1 illustrates a compression tool, constructed according to the present invention, and generally indicated by the reference numeral 30. Compression tool 30 includes a body 40 with a compression tip carriage 42, carrying a compression tip 44, disposed in open channel 46 formed in body 40 for axial motion relative thereto, as shown by the single-headed arrow on Figure 1.

As best seen on Figures 3 and 4, body 40 is actually two pieces 40' and 40'' of stamped sheet metal separated, in part by a portion of plastic member 50 (Figure 3), in part by upper intermediate member 52 (Figure 3), in part by upper end member 54 (Figure 3), in part by lower immediate member 56 (Figure 4), and in part by lower end member 58 (Figure 4).

Referring again to Figure 1, pieces 40' and 40'' (Figures 3 and 4) are fixedly fastened together by suitable fasteners 60, 62, 64, and 66.

Continuing to refer to Figure 1, a handle 70 is rotatably attached to compression tip carriage at a first pivot point 72.

As best seen on Figure 4, handle 70 is actually two pieces 70' and 70'' of stamped sheet metal separated by a portion of a plastic member 80, the two pieces being held fixedly together by suitable fasteners 82 and 84.

Referring again to Figure 1, an intermediate link 90 formed from stamped sheet metal is rotatably attached at one end thereof to handle 70 at a second pivot point 92 and at the other end thereof to body 40 at a third pivot point 94. First and second, upper and lower spring loaded jaws 100 and 102 are rotatably attached, respectively, to upper and lower end members 54 and 58 by means of

first and second upper and lower pins 104 and 106. Upper and lower guard extensions 110 and 112, respectively, are provided to protect jaws 100 and 102.

Continuing to refer to Figure 1, the relative positions of pivot points 72, 92, and 94 are an important aspect of the present invention in providing toggle action and the resulting wide range of mechanical advantage. Here, dimensions A, B, C, and D preferably are spaced the following approximate distances:

$$A = 1.0$$

$$B = 8.0A$$

$$C = 1.4A$$

$$D = 8.4A.$$

Referring now to Figure 2, compression tool 30 is shown in its fully closed position wherein dimension $E = 0.2A$ and dimension $F = 9.5A$. Figure 2 also illustrates that tactile feedback is given when the end of a compression cycle is reached by the engagement of upper and lower stops 120 and 122, respectively, formed as extensions of upper and lower plastic members 50 and 80. A shoulder 48 formed on compression pin carriage 42 engages the end 49 of chamber 46 (Figure 1) to limit the degree of opening of compression tool 30.

Figures 5 and 6 illustrate the operation of compression tool 30. Referring first to Figure 5, uncompressed end connector parts 130 and an end of a coaxial cable 132 (shown in broken lines) are placed in chamber 46 and supported therein by spring loaded fingers 100 and 102 and compression pin 44. Handle 70 is then rotated from the position shown on Figure 5 (also Figure 1) to the position shown on Figure 6 (also Figure 2). This action compresses parts 130 and fixes them to the end of coaxial cable 132 and the finished product is then removed from tool 30.

Referring now to Figure 7, to assist in loading unassembled parts 130 and end of coaxial cable 132 (Figure 5) into chamber 46, finger pads 140 and 142 provided as extensions of spring loaded fingers 100 and 102 may be squeezed together to open the spring loaded fingers. A guard member 150 protects finger

pads 140 and 142.

Elements 100, 102, 104, 106, 110, and 112 (all best seen on Figure 1), and 140, 142, and 150 (all best seen on Figure 7) are formed in a single unit fixedly inserted into a transverse slot 160 defined in body 40.

5 With the above dimensions, the mechanical advantage of compression tool 30 increases from 4:1 in the open (uncrimped) position (Figure 1) to 200:1 in a nearly closed (fully crimped) position (Figure 2), a substantial increase over conventional compression tools. This minimizes user fatigue and promotes high levels of productivity.

10 Figure 8 illustrates basic tool 30 (Figure 1) with the addition of fixed and movable auxiliary jaws 200 and 202, respectively, the tool being indicated generally by the reference numeral 30'. Elements similar or identical to those of tool 30 are given primed reference numerals. Fixed auxiliary jaw 200 replaces upper end member 54 (Figure 7) and is an extension of body 40'. Movable auxiliary jaw 202 is an extension of compression pin carriage 42 (Figure 1) and replaces upper intermediate member 52. Movable auxiliary jaw 202 is guided in part by a pin 210 movable axially in a slot 212 defined in body 40'. It will be understood that tool 30' may be used for attaching two different end connectors to cable (neither shown).

15 20 Figure 9 further illustrates the components of tool 30'.

Figure 10 illustrates basic tool 30 (Figure 1) with an end extension 300 and a sliding plate 302, respectively, the tool being indicated generally by the reference numeral 30". Elements similar or identical to those of tool 30 are given double primed reference numerals. End extension 300 replaces upper and lower end members 54 and 58 (Figure 7) of tool 30 and is fixedly clamped between pieces 40'" and 40'" of body 40" (Figure 11). Sliding plate 302 replaces the elements in slot 160 (Figures 1 and 7) and is movably held in slot 160" by means of a ball detent lock mechanism 318 extending through end extension 300 and grippingly bearing against the sliding plate.

25

Figure 11 illustrates tool 30" configured to attach end connectors to a first range of cable sizes, with sliding plate 302 moved to an inactive position and held there by means of ball detent lock 318 such that a cable (not shown) is supported by end extension 300.

5 Figure 12 further illustrates the arrangement of Figure 11.

Figures 13 and 14 illustrate sliding plate 302 moved to an active position and held there by means of ball detent lock 318 such that a cable (not shown) is supported by the sliding plate.

10 Figure 15 illustrates a further embodiment of the present invention, indicated generally by the reference numeral 500, the tool incorporating a stripping function. Since the stripping function may be used with any of the foregoing embodiments, only the features pertinent to the stripping function are given reference numerals and described.

15 Tool 500 includes a finger opening 510 disposed intermediate the ends of a handle 512, the handle having a handle lock 514 disposed between the distal ends of the handle and one side of a body 516. A compression pin carriage 520 has an opening 522 defined therethrough for the insertion therein of a coaxial cable (not shown). Compression pin carriage 520 has mounted on the near side thereof an insulation cutting blade 530 fixedly attached to the compression pin carriage by means of a threaded screw 532 and a locating pin 534. On the far side of compression pin carriage 520 there is mounted thereto a notched cutting blade 540 fixedly attached to the compression pin carriage by means of a threaded screw 542 and a locating pin (not shown) similar to locating pin 534. A return spring 550 is disposed between an upwardly extending flange 552 on compression pin carriage 520 and an upper intermediate member 554, the compression spring biasing the compression pin carriage to the right on Figure 15, thus causing handle 512 to move from the closed position shown on Figure 15 to an open position (similar to that shown on Figure 1) when handle lock 514 is released.

20

25

COMPRESSION TOOL WITH TOGGLE ACTION

Inventor: Richard A. Steiner

PATENT

122-113

Figure 16 illustrates more clearly the mounting of cutting blades 530 and 540.

In the stripping operation, a coaxial cable (not shown) is inserted into opening 522. Then, handle lock 514 is rotatably released, thus permitting compression pin carriage 530 to move rearwardly on Figure 15, forcing the coaxial cable against arcuate indentations formed on the two halves of body 516 and moving handle 512 to its open position. Insertion of a finger (not shown) in finger hole 510 and rotation of tool 500 about the coaxial cable causes cutting blade 530 to cut through the outer insulation layer on the coaxial cable, exposing the braided shield of the cable, and notched cutting blade 540 to cut to the center conductor on the cable. The cut material is then removed by pulling the coaxial cable from tool 500. Tool 500 can then be used in the manner described above to crimp end connectors to the cable.

From the above description, it is apparent that minimal variations to a basic tool permit a wide range of connectors to be compressed by the tool or coaxial cable stripped by the tool. These connectors include those furnished by Thomas & Betts (Snap-N-Seal), Gilbert (Ultra Seal), PPC (EXXL), and Antec (Digicon).

Having the handle behind the compression chamber offers the advantage of having easy access on MDU (multiple dwelling unit) enclosures and wall plate stub-ins.

Terms such as "above", "below", "upper", "lower", "inner", "outer", "inwardly", "outwardly", "vertical", "horizontal", and the like, when used herein, refer to the positions of the respective elements shown on the accompanying drawing figures and the present invention is not necessarily limited to such positions.

It will thus be seen that the objects set forth above, among those elucidated in, or made apparent from, the preceding description, are efficiently attained and, since certain changes may be made in the above construction without

COMPRESSION TOOL WITH TOGGLE ACTION
Inventor: Richard A. Steiner

PATENT
122-113

departing from the scope of the invention, it is intended that all matter contained in the above description or shown on the accompanying drawing figures shall be interpreted as illustrative only and not in a limiting sense.

5 It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

1003403 123401